

AUTOMATIC E-TOLL SYSTEM WITH NAVIGATION, TRACKING, PURCHASING AND CHALLANING USING RFID

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ABSTRACT:

This paper focuses on various applications of radio frequency identification (RFID) technology. There will be RFID card fitted on the vehicle which is assigned to the owner with an unique identification (UID) number. The payment of toll will be collected from prepaid account registered on the name of vehicle owner. When the vehicle passes to the toll gate, the information is shared between RFID tag and RFID card reader. If there is insufficient balance in the account, the vehicle will not be allowed to cross the toll gate and the respective authorities will be informed. The stolen vehicles can be identified and recovered from the toll gate by using RFID tracking mode. IR sensors are being used to calculate the speed so that challan can be issued if vehicle exceed the maximum speed limit. RFID cards can be used for navigation over small distances which help the driver to reach the destination without any hassle. The purchasing of eatables can be done utilizing the RFID card.

KEYWORDS: - Electronic Toll Collection, UID, RFID tag, challan, tracking, purchasing.

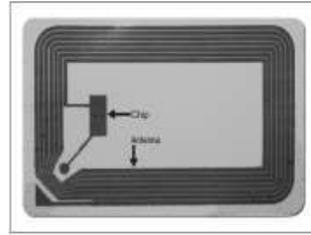
INTRODUCTION:

RFID technology has been capturing many sectors now- a- days like healthcare, security, construction, hospitality and transport sector. The RFID systems can be used for collecting the toll at toll plaza to avoid human error at often occur at the toll booth. There have been numbers of reasons to introduce these systems in the vehicles one of the most prominent factor can to avoid the road accidents. This technology can be helpful in reducing the traffic congestion as well as the fuel wastage that occurs due to long wait near the toll. Over the highways over speeding is very common this can be brought to check by using RFID. In this passive RFID cards are being used which carry a Unique Identification number (UID) that will store all the information of the vehicle owner.

General Terms RFID is an automated data-capture technology that can be used to electronically identify, track, and store information contained on a tag. A radio frequency reader scans the tag for data and sends the information to the database, which stores the data contained on the tag. The main technology components of an RFID system are the tag, reader, and database.

RFID SYSTEMS:

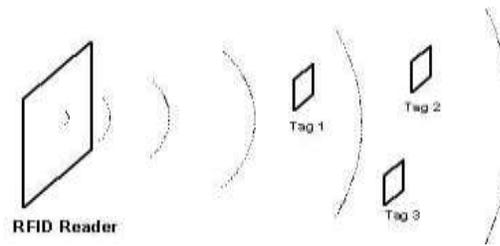
RFID is an automatic identification technique which relies on data storage and trans-receiving of data using devices known as RFID tags.. The mode of communication between the reader and the tag of an RFID system is based on radio frequency (RF).



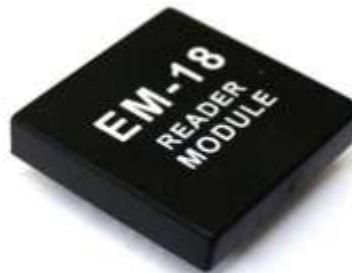
RFID chip:

RFID READERS:

A reader uses its own antenna to communicate with the tag. It has the capability to communicate with the tag without a direct line of sight, depending on the radio frequency and the type of tag (active, passive, or semi passive) used.



RFID CARD SENSING RANGE:



RELATED WORK:

The ETC system is currently being used throughout the world. In the United States alone, various states have implemented an ETC system called E-Z Pass. Other countries that have applied the ETC system are Canada, Poland, the Philippines, Japan and Singapore, among many others.

PIN CONNECTIONS:

1. On pin 10 and 11, max IC is connected which is used to interfacing with PC. On 13 pin of max 232, Computer is connected.
2. On pin 40 and 31, power supply is provided.
3. On pin 22 and 21, two transistors are connected to protect the controller from back impulse from the motor.
4. L293D motor driver is connected to these transistors which help in lifting and closing of the toll gate.
5. On pin 3.0, EM-18 RFID card reader is connected which is used as an antennae to receive signal from the RFID of the user.
6. Pin 18 and 19 are connected to crystal oscillator.
7. On pin 1,2,3,4 IR Sensors are connected to sense the car.
8. Pin 20 is grounded.

WORKING:

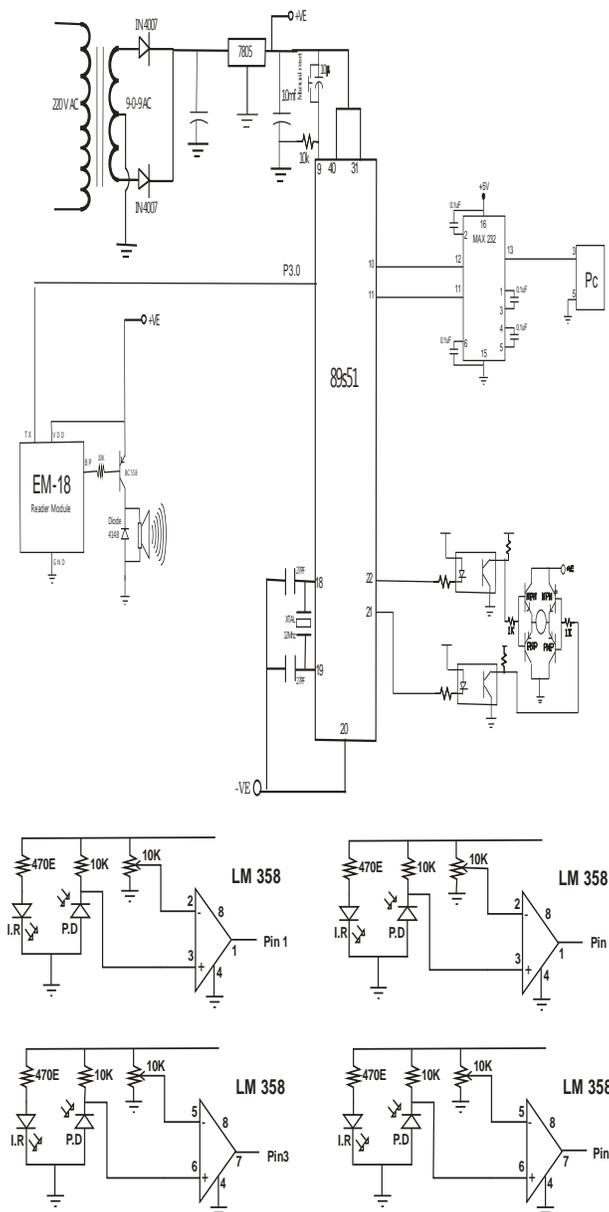
Workings of the various application of RFID are explained briefly:

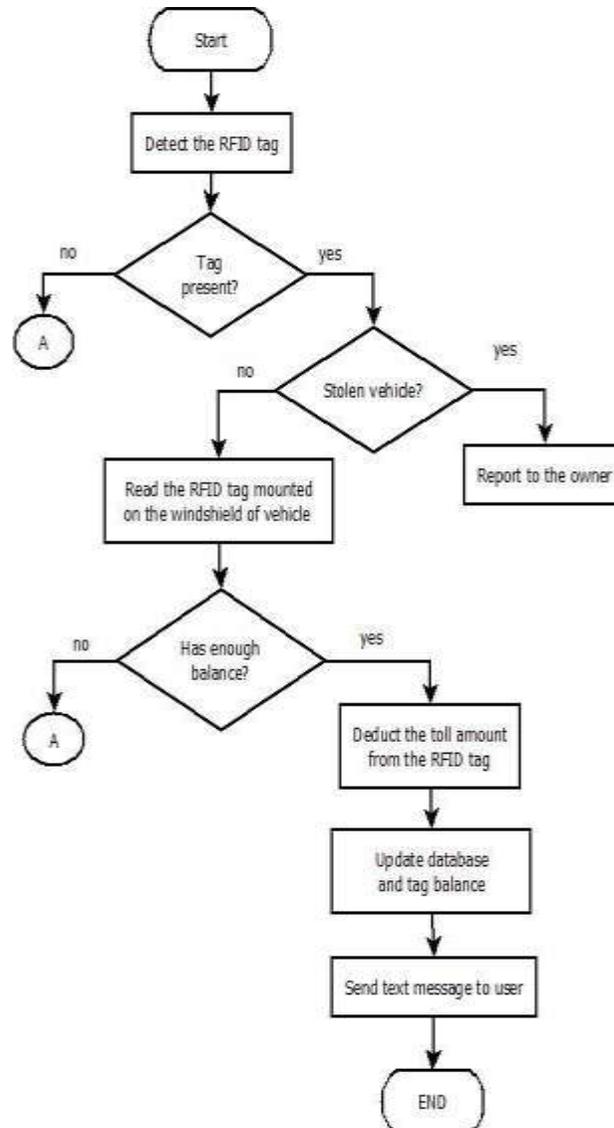
Using smart card in a car can be a great use as it can be used in various applications to make the highway traffic free.

First two IR sensors are used as speedometer to calculate the speed of the upcoming car. These IR sensors are placed at a fixed distance. When the car passes first sensor, a clock cycle is started which continues till the second sensor is passed. This provides the time period with ultimately speed and distance which will be fixed. RFID reader (EM-18) is placed at second sensor which is used to recognize a car with its RFID tag. Now both information i.e. speed and RFID tag number are passed to microcontroller which in turn passes it to computer through max IC 232. Here a program is run by the computer in which a constant speed limits which is already fixed. The speed calculated is compared with this value and if it would exceed this value then the challan will be deduced from respective RFID holder.

If car is stolen, RFID no. is not present or user does not have RFID, in these cases gate will not open.

In case of stolen id case an immediate message will be sent to respective officer and real user. Alarm trigger circuit can be also used.





Our next application is E-Toll system. When the user comes at toll tax system, the whole process will be done in nano seconds. First the IR sensors will sense the upcoming car and alert the system to get ready as card is about to come. EM-18 is used as a RFID card reader when the card passes through its pre existing magnetic field get distorted in a unique way and card is starting to read, this information is transferred to controller from where it is converted from TTL logic to serial logic using MAX IC and passed to the database (PC). Here a unique RFID no. of the car is matched to pre existing RFID no. in the database, after checking the data like stolen car information, vehicle number etc the database will deduct the toll money from the RFID tag and give an ok single will be sent to controller which send this signal to IC 2393D which is also known as Motor Driver IC. It is a dual H bridge connected by the stepper motor which gives the clockwise and anticlockwise signal to the motor. It generates a clockwise signal to the stepper motor. Now, the barrier will be opened and the car will enter on the toll gate. Now the second IR sensor will sense the going car from the toll gate and send a signal again to the microcontroller which will instruct L293D to change polarity and rotate the motor in anticlockwise direction and close the gate. The user will get the text message about the deduction of the money .From the RFID tag once the car crosses second IR sensor, the system again go in the passive mode.

RFID cards can be used for purchasing goods. The balance on the RFID card can make it possible. User can use the same for purchasing food stuff etc, at the time of payment, the user will put the tag on the RFID card reader, the signal from the RFID reader card goes to database through the microcontroller and MAX IC 232. The database checks whether the tag has enough balance or not for the giving the payment. If it's not, the system will show on the screen that the tag has not the enough balance. If it is, then the database will send a signal to the system for the payment slip and deduct the balance from the user's tag.

The RFID can be used for the navigation purposes as the RFID consists of this feature also. RFID chip with higher frequency than the normal RFID chip is used for purpose of navigation. Navigation on small level can be done by using naïve bayes theorem is used to tell the best probability and maximum used route for easy directions.

ALGORITHM

Bayes theorem provides a way of calculating the posterior probability, $P(c/x)$, from $P(c)$, $P(x)$, and $P(x/c)$. Naive Bayes classifier assume that the effect of the value of a predictor (x) on a given class (c) is independent of the values of other predictors. This assumption is called class conditional independence.

$$P(c | x) = \frac{P(x | c)P(c)}{P(x)}$$

Posterior Probability Likelihood Class Prior Probability
Predictor Prior Probability

$$P(c | X) = P(x_1 | c) \times P(x_2 | c) \times \dots \times P(x_n | c) \times P(c)$$

- $P(c|x)$ is the posterior probability of class (target) given predictor (attribute).
- $P(c)$ is the prior probability of class.
- $P(x/c)$ is the likelihood which is the probability of predictor given class.
- $P(x)$ is the prior probability of predictor.

PROGRAMMING:

The circuit system needs programming as a soul to make the system centralized and digitalized without any error. The embedded technology is used in modern electronics. To make the RFID works, programming will be used with the integration of the servers (database).

For pc system

1. C sharp
2. Serial communication protocol
3. DBMS

ENHANCEMENTS:

Every project has the scope for the improvement as research and development is the endless process.

The advancements are:-

1. An email can be sent to the user about the low balance in the account to remind him/her to recharge the card.
2. RFID card can be used as a universal card to buy things from markets like a credit card.
3. In navigation, fid cards can be improved to give accurate and convenient positioning of the map.

SCOPE OF THE PROJECT:

In order to make a system successful we have to keep in mind the following important features: Accuracy: All the logical dependencies that are functionally bonded must be integrated. Efficiency: The system should be able to work under all circumstances and on a long run it must work effectively irrespective of their proprietary format. Cost Effectiveness: As our database made for the project does not require any special software for its implementation hence it is less costly as compared to other systems. Any Prerequisite for the use: There is no need for the extra training as the existing systems are not changed, and integration is done at the background level itself.

CONCLUSION:

This paper comprises of the application of RFID. RFID tags and reader is the main component used in the RFID technology. The tags store information and are usually installed on the cars. This paper gives many advantages like no waiting on highways, less traffic, no congestion, assured and accurate collection of toll, free from cashless environment. The anti theft feature prevents the defaulter/stolen vehicles from being applied to ensure security on the roadways.

Printing papers for tickets on toll can be reduced as it's a cashless and full computerized process.

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REFERENCES:

- [1]. NingHuansheng, Zhang Yan, "RFID and Internet of Things", Beijing, Electronic Industry Press, @008, pp.18-26 (China).
- L. Jerry, C. Barbara "shrouds of Time: The History of RFID". AIM Publication, ver.1.0,2001.
- M. Avoub Khan, S. Manoj and R.B. Prabhu "A Survey of RFID Tags", International Journal of Recents in Engineering, vol 1, no 4, May2009.
- W.C. Tang, T.V. Ho, "Electronic Toll Collection System", US Patent, US 7233260 B2, June 2007.
- Radhika et al, "Electronic Toll Collection System", UNIASCIT, Vol 1 (1), 2011, 05-08.
- Pavel V. Nikitin, hashi Ramamurthy, Rene Martinez, "Simple Low Cost RFID UHF Reader". IEEE International Conference on RFID, 2013.
- SudhaBhalekar, AdeshChanegiri G., Indra Prakash Chauhan "automatic Toll Tax using RFID", IJCTEE Volume 3, Special Issue, March- april 2013, An ISO 9001:2008 Certified Journal.
- N. Gabriel, I. Mitraszewska, K. Tomasz, "The Polish Pilot Project of Automatic Toll Collection System", Proceedings of the 6P the International Scientific Conference TRANSBALTICA, 2009.
- D.D.E. Crispin, U.M. Aileen, G.S. Ricardo, J.M Jim, S.P. Hilario, "Allocation of Electronic Toll Collection Lanes at Toll Plazas Considering Social Optimization of Service Times and Delays", Proceedings of the Eastern Asia Society for Transportation Studies, vol. 5, pp. 1496–1509, 2005.
- W.C Tang, T.V. Ho, "Electronic Toll Collection System", US Patent, US 7233260 B2, June 2007.
- M.S Ismail, M.Y KhairUI-Anwar, A.Z. Zaida, "Electronic Toll Collection (ETC) Systems Development in Malaysia", PIARC International Seminar on Intelligent Transport System (ITS) in Road Network Operations, August 2006
- F. Don, "Electronic Toll Collection: An Introduction and Brief Look at Potential Vulnerabilities," in SANS Institute infoSec Reading Room, 1.4b ed. 2004.
- S. Lauren, B. Mariko (2007, June 20). Electronic Toll Collection [Online]. Available: 5TUhttp://www.atm.comU5T
- C.M. Roberts, "Radio Frequency Identification (RFID)," Computers & Security, Elsevier, 2006.
- L. Jerry, C. Barbara "Shrouds of Time: The History of RFID", AIM Publication.